

DTU Space  
National Space Institute

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Technical University of Denmark

www.space.dtu.dk

## ICEGRAV-2010/11 ..

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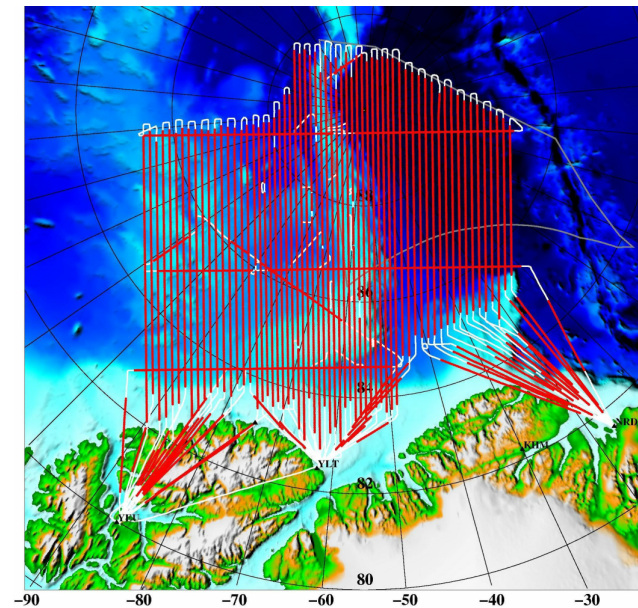
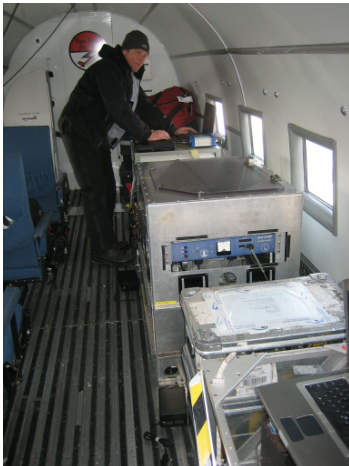
DTU-Space

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## ICEGRAV-2010

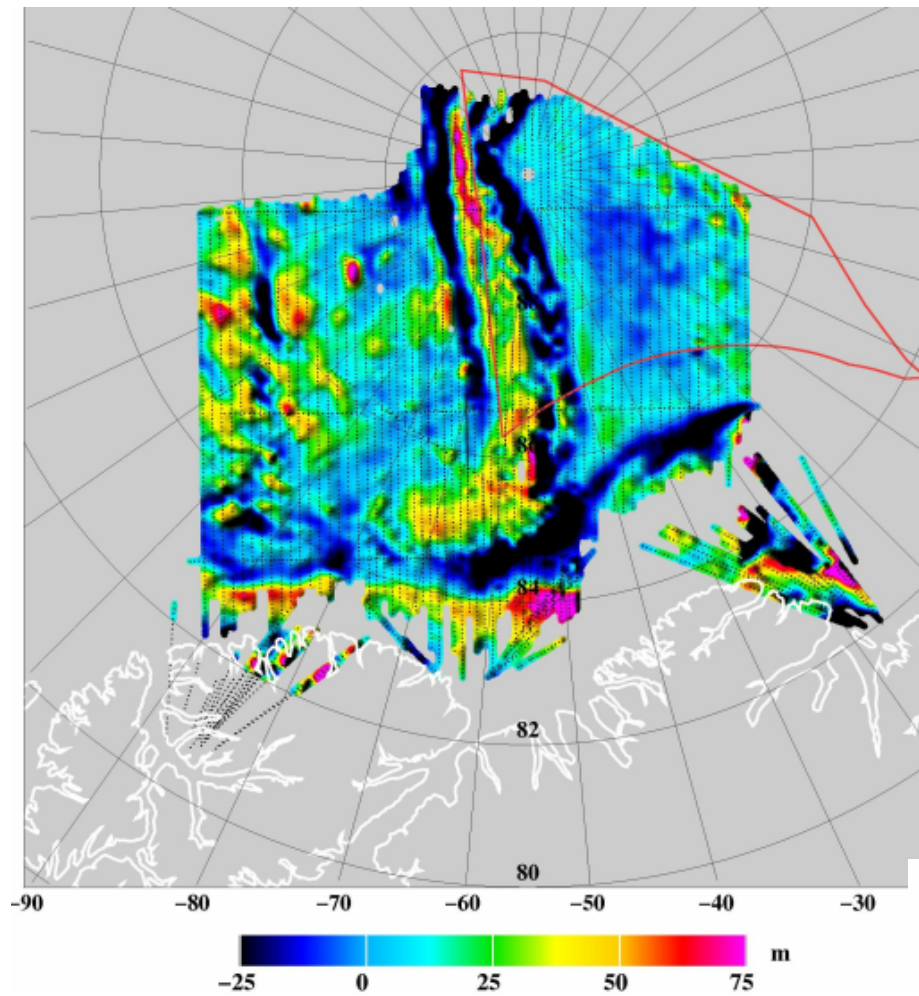
- ICEGRAV-2010 first Danish airborne geophysics campaign in Antarctica
- Overall goal: Improving gravity field coverage for global models and support for satellite gravity missions (GOCE, GRACE), support for Antarctic Geoid Project
- Continuation of long-standing cooperation DTU-NGA of Arctic and International gravity surveys (Greenland, Arctic Canada, Mongolia, Ethiopia, Indonesia ..) in global gravity field modelling (airborne gravimetry, satellite altimetry, EGM2008)
- Basis for cooperation: Successful 2009 grav+mag survey with Ken Borek Basler-DC3, joint DTU-Space / Geological Survey of Canada (Halifax) survey  
*256 flight-hr in 6 weeks, 1.7 mgal rms error (S99), estimate from 210 x-ings*  
*Total field Cesium magnetometer + SWARM vector magnetometer*



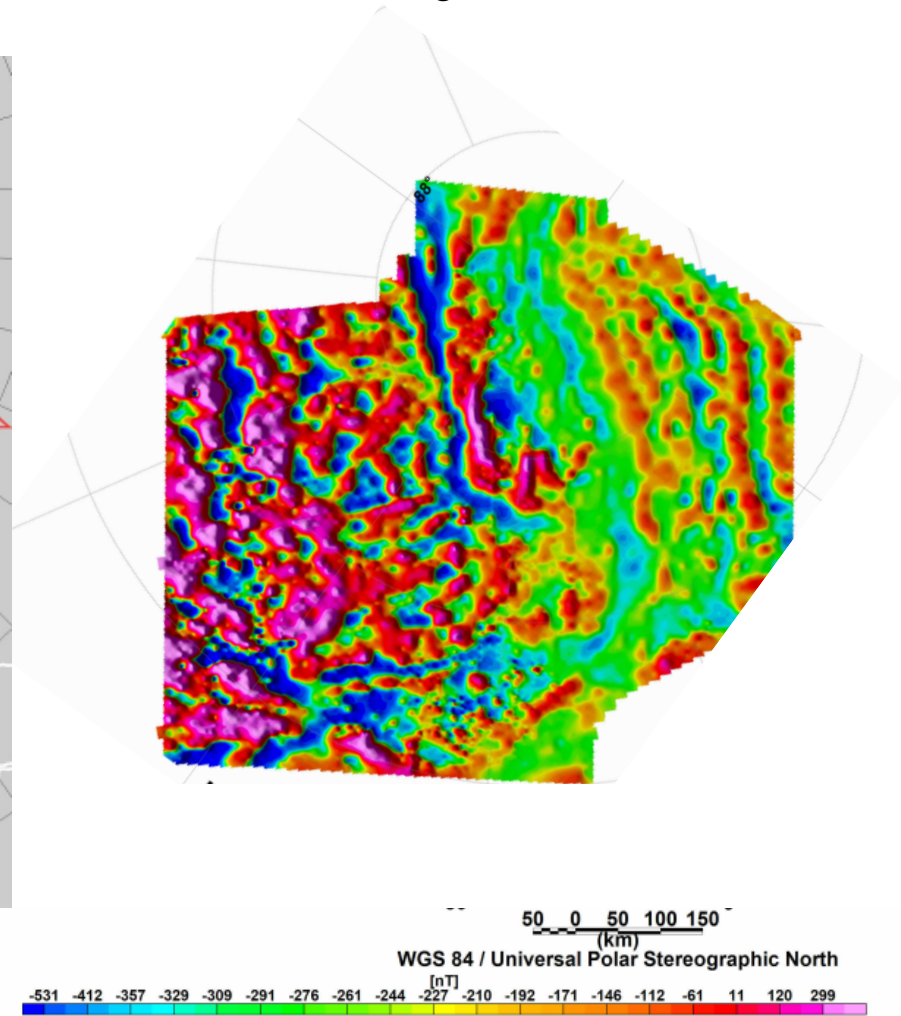


## LOMGRAV09

Gravity anomalies



Total magnetic field

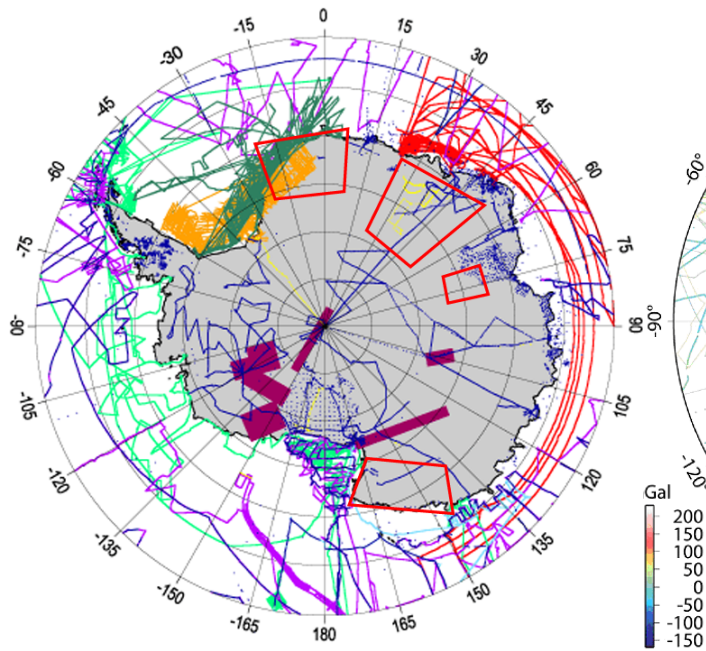


## Antarctica ... last major gravity void on the planet ..

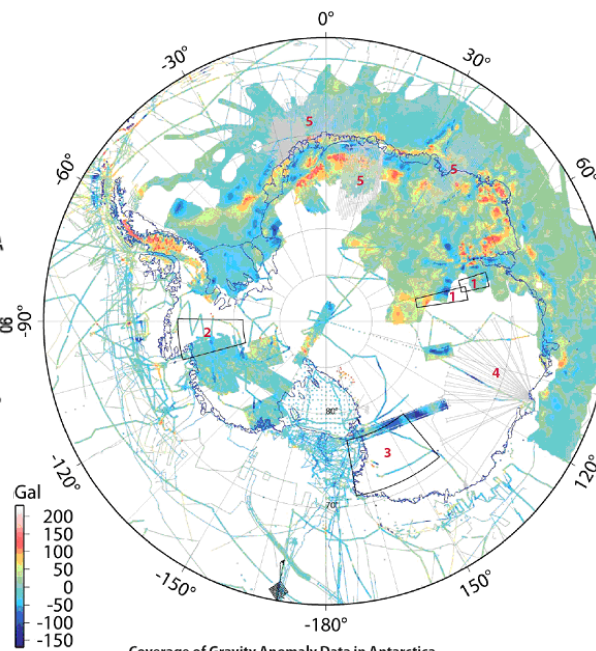
"Arctic Gravity Project" (1998-2008) sets model for cooperative surveys and data exchanges .. geodesy needs (IGFS)

Airborne gravity only feasible methods to cover the whole region in 5 years  
.. need long-range aircraft for deep interior (DC3, Halo, P3, Russian IL76 ...)

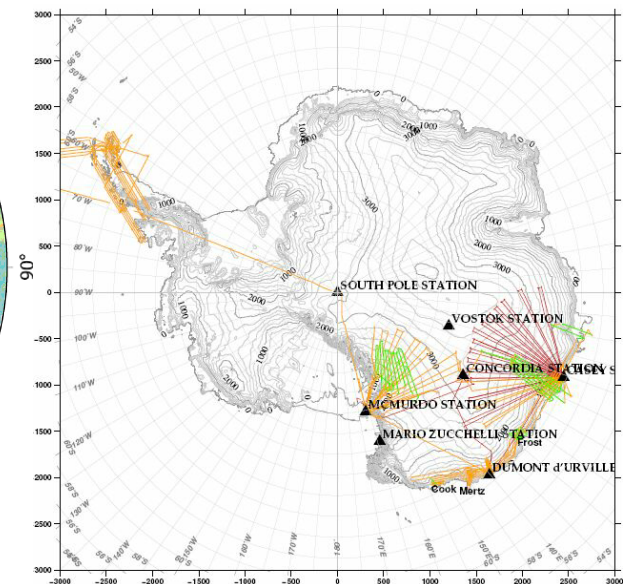
*IAG Antarctic Geoid Project (AntGP) .. complement ADGRAV, BEDMAP...*



Gravity data coverage in Antarctica  
(shipborne, airborne and terrestrial observations)  
Map source: ADGRAV (Antarctic Digital Gravity Synthesis)



Coverage of Gravity Anomaly Data in Antarctica  
IAG Commission Project 2.4, "Antarctic Geoid"  
Mirko Scheinert, TU Dresden



ICECAP flights (U Texas)



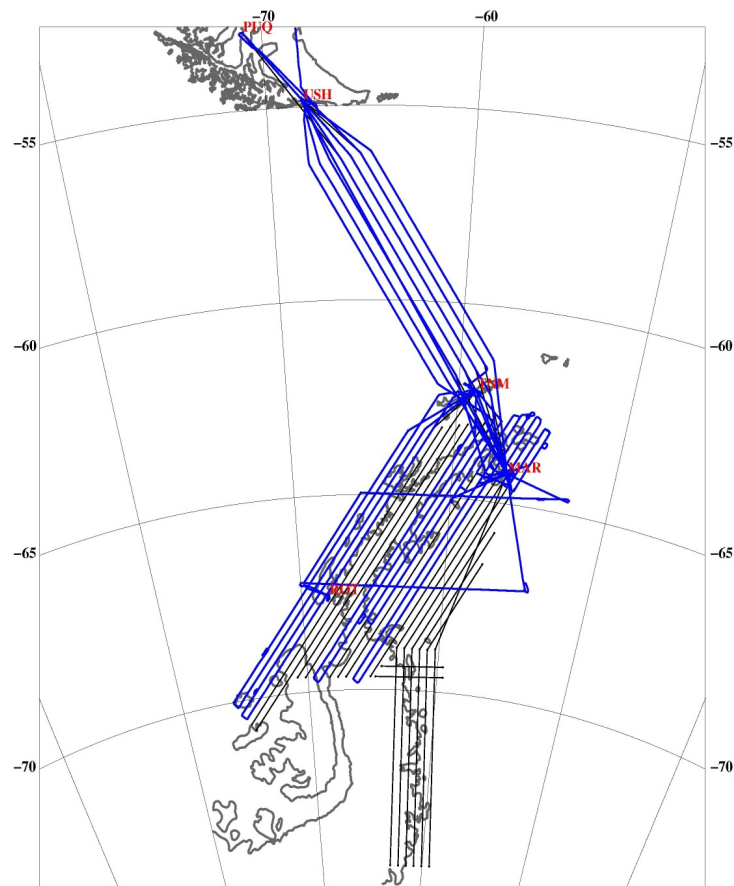
## ICEGRAV Jan-Feb 2010

- DTU-Space first project in Antarctica, funding from NGA, NASA and DTU  
*[1st major Danish activity after Denmark joined SCAR 2006]*
- Cooperation with University of Texas ICECAP (60 MHz Texas/JPL/TUD radar), Instituto Antartico (Argentina), CECS (Chile), University of Bergen (Norway)
- Overall goals:
  - Gravity – to support AntGP and global gravity field modelling (EGM08)*
  - Geoid – ocean circulation and MDT in Drake Passage*
  - General geophysics, laser altimetry, ice-penetrating radar*



## Planned and actual flight tracks

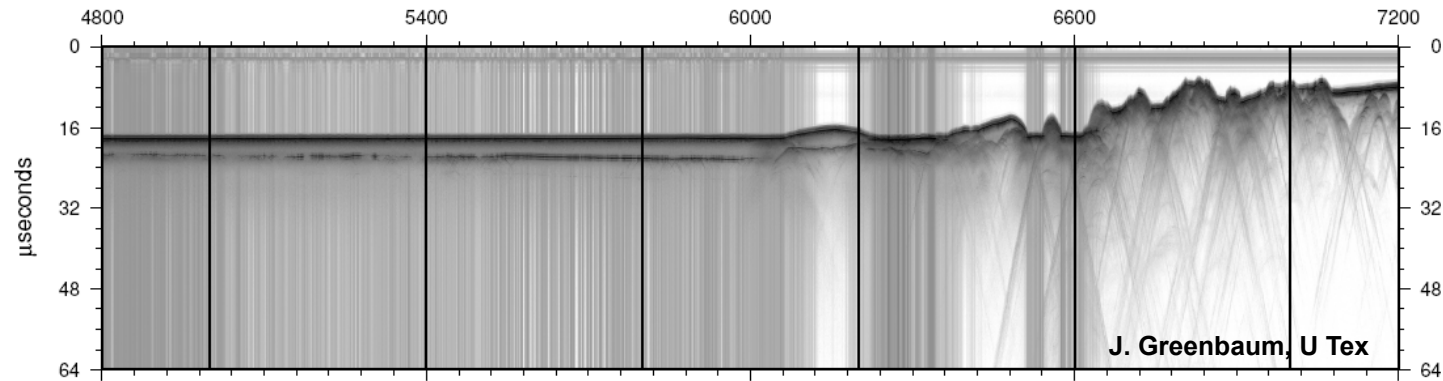
*Weather uncooperative ... Marambio runway very frequently in fog and clouds*



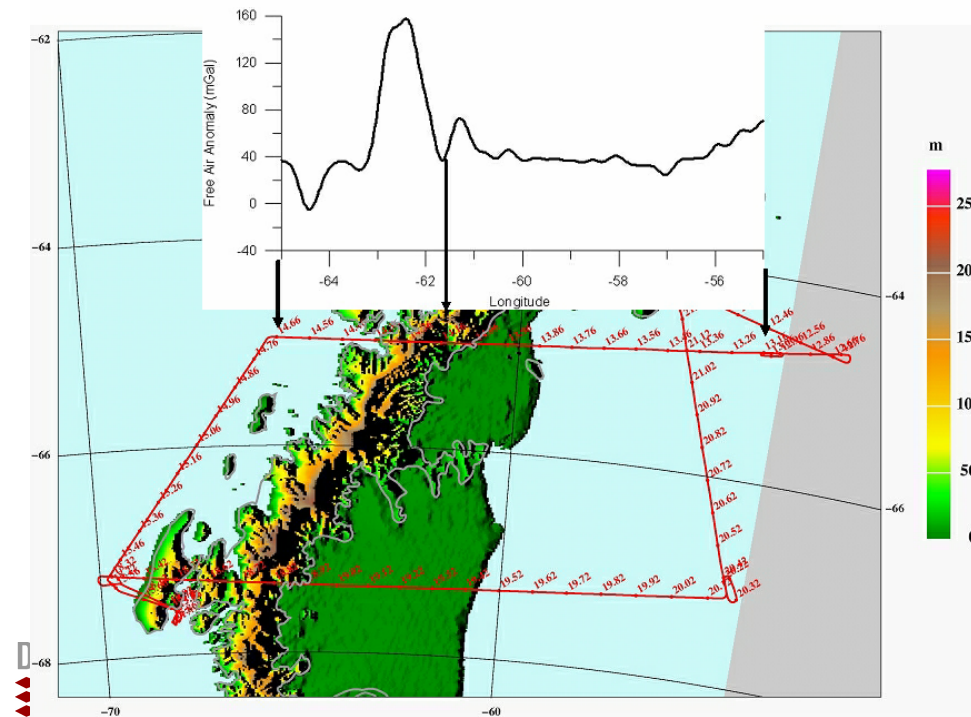


## Data examples

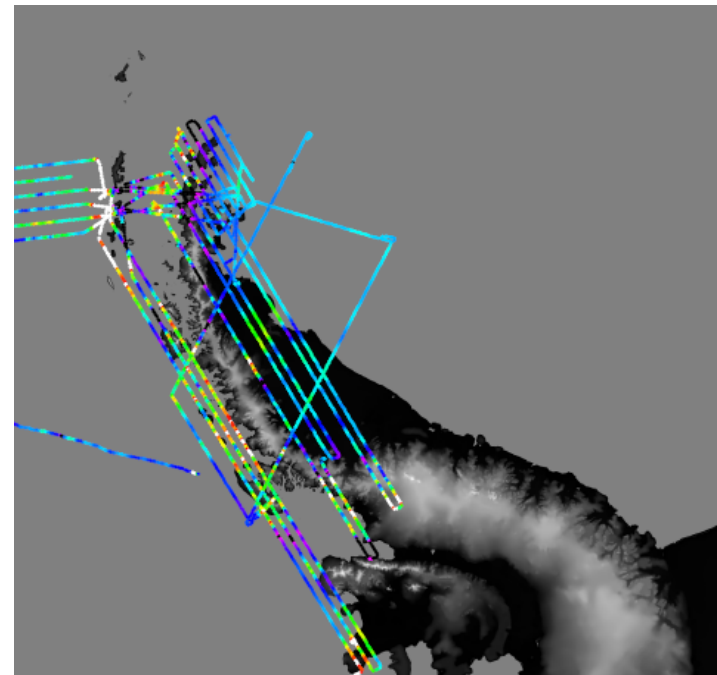
Larsen C – Peninsula quick look radar profile



Gravity profile example



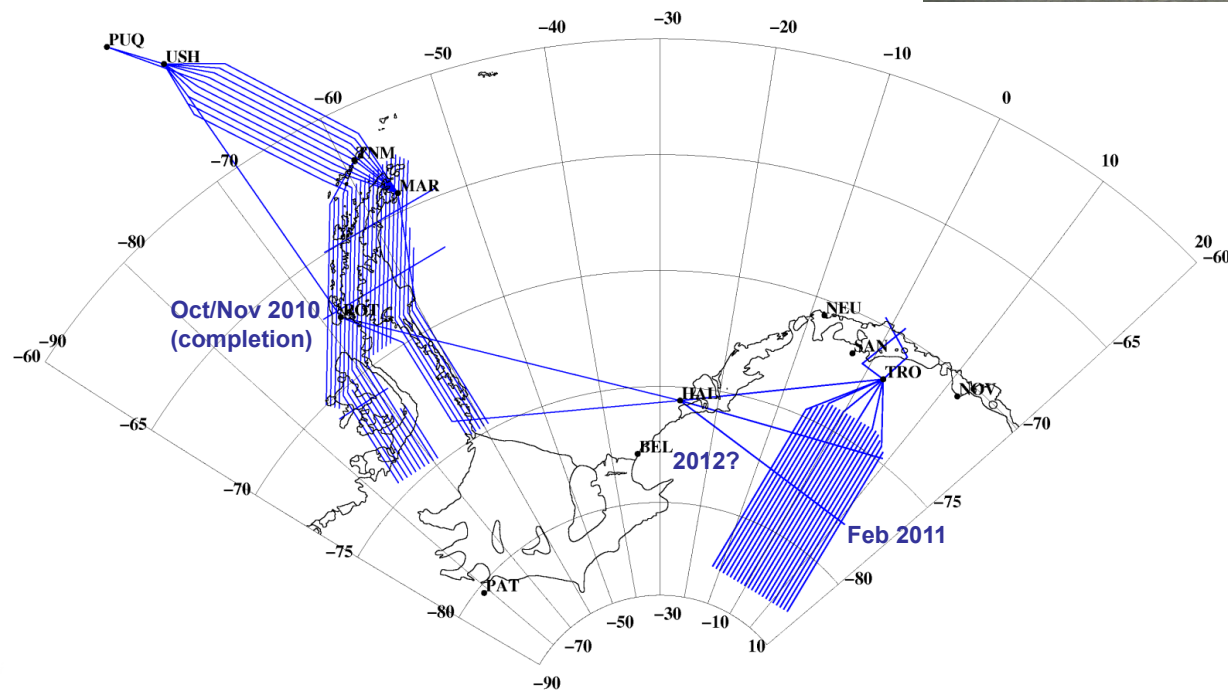
Total field magnetic data



## Upcoming cooperative surveys – ICEBridge cooperation

- Complete peninsula (Oct-Nov 2010), cooperation BAS/UTexas/IAA)
- Sea-ice lidar flights with BAS (Nov 2010)
  - .. *James Clark Ross icebreaker coordinated experiment*
- Starting East Antarctica programme in cooperation with Norwegian Polar Institute, British Antarctic Survey and IAA

*Hardware flown: Gravimeter (LCR, Mag, 60 Mhz radar (Hicars), laser)*  
*East Antarctica (Feb 2011) additionally flown:*  
*DTU/ESA P-band polarimetric (450 MHz), Chekan gravimeter*





## Conclusions

- Airborne gravity operational .. *need for international cooperative effort to cover all of Antarctica .. from global geodesy, satellite gravity missions GRACE and GOCE*
- Arctic successfully covered by airborne gravity and surface data in ArcGP – *cooperative model for Antarctica? All major voids could be filled by 2015 ...*
- DC3 economic and efficient platform for long-range surveys (*geodesy, regional geophysics and glaciology ...*)

